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(54) Title of the Invention: SEMICONDUCTOR DEVICE

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Specification

1. Title of the Invention

SEMICONDUCTOR DEVICE

2. Claims

(1) A semiconductor device characterized as being provided with a first semiconductor element, whereon a semiconductor part, or bonding pad, and a first contact area are formed, and a second semiconductor element, whereon at least a second contact area is formed, and by the fact that said first bonding area formed on said first semiconductor element and said second bonding area formed on said second semiconductor element are opposingly connected via a connecting material.

(2) The semiconductor device according to claim 1, further characterized by the fact that a plurality of circuits are formed on the surface wear said contact area of said second semiconductor element is formed.

(3) The semiconductor device according to claim 1, further characterized by the fact that a coating which blocks radiation is formed on the face upon which said contact area of said second semiconductor element is not formed.

3. Detailed Description of the Invention

The present invention concerns a semiconductor device that is able to prevent software errors caused by alpha rays.

Normally, in semiconductor integrated circuit devices, electrical parts such as transistors, diodes, resistors and capacitors are formed near the surface of a semiconductor substrate made of a material such as silicon, and the semiconductor element having a conductive connecting wire of made of a material such as aluminum is placed in contact with a package made of a ceramic material, the bonding pads on the chip and package leads are connected by means of a fine electrical wire made of a material such as aluminum, and the package is covered with a cover. Recently, however, the problem of so-called software errors, whereby errors occur in the operation of a semiconductor integrated circuit device due to alpha rays radiated from parts such as the ceramic package, has gained attention. This is a problem that occurs when alpha rays radiated from not only the ceramic that makes up the package material but also from the metallic cover and bonding material of the cover are irradiated into the surface, creating electron-hole pairs in the semiconductor substrate, carriers of which produce errors in the operation of the semiconductor integrated circuit device.

Accordingly, the objective of the present invention is to offer a semiconductor device that is able to prevent software errors by blocking alpha rays.

In order to achieve this purpose, the present invention offers a semiconductor device characterized as being provided with a first semiconductor element, whereon a semiconductor part, or bonding pad, and a first contact area are formed, and a second semiconductor element, whereon at least a second contact area is formed, and by the fact that said first bonding area formed on said first semiconductor element and said second bonding area formed on said second

semiconductor element are opposingly connected via a connecting material. The present invention is explained in further detail below using a working example.

Figure 1 is a plan view showing a working example of a semiconductor device according to the present invention, and Figure 2 is a cross-sectional view along the line A-A' in Figure 1. In these figure, 1 denotes a first semiconductor element which includes a semiconductor member, 2 denotes a plurality of bonding pads provided on the edges of said first semiconductor element 1, 3 denotes metallic in wire which is in contact with these bonding pads 2, 4 denotes a first contact area formed on the first semiconductor element 1, 5 denotes a semiconductor element mounting stage, 6 denotes a second semiconductor element having a thickness so as to be impenetrable by, 7 denotes a second contact area formed on this second semiconductor element, and 8 denotes a bonding material comprising a solder ball which connects the aforesaid first contact area 4 and second contact area 7.

The thickness of this second semiconductor element 6, as described above, must be such that alpha rays cannot penetrate it, but since alpha rays normally have an energy of about 5 MeV and can only penetrate barely to 25-30 μm in silicon, a thickness greater than this is able to prevent the penetration of alpha rays, and since the thickness of this element is normally 200 μm or more, it is sufficient.

Next, the operation of the semiconductor device according to this constitution is explained.

First, the first semiconductor element 1 and second semiconductor element 6 are formed separately by publicly known methods. Multiple bonding pads 2 and a first contact area are formed on the periphery of the first semiconductor element 1, and this first contact area may be formed by nickel or copper plating. Meanwhile, after a second contact area 7 has been formed on the second semiconductor element 6, a connecting material 8 comprising solder balls is provided, and this second contact area 7 is formed of a normal metallic material for wiring, for example, by plating of nickel or copper on aluminum. Next, the second semiconductor element 6 is inverted, and the first contact area 4 and second contact area 7 are positioned so as to match with adhesive material 8 interposed. Next, by performing a treatment in a N_2 gas atmosphere of 300°C, the first contact area 4 and second contact area 7 can be connected by the adhesive material 8. Thus, a composite semiconductor element in which the first semiconductor element 1 and second semiconductor element 6 are bonded is mounted on the semiconductor element mounting stage 5 of the package. One end of the metallic thin wire 3 is then connected to a bonding pad 2 while

the other end of the metallic thin wire 3 is connected to a lead wire of the package not shown in the figure.

Since alpha rays radiated from the package, cover, etc. are blocked by the second semiconductor element 6 in a semiconductor element constituted in this way, software errors can be prevented. Moreover, since the gap between the first semiconductor element 1 and second semiconductor element 6 is small, or alpha rays incident from the lateral direction are negligible. Since metallic thin wire 3 is in the vicinity of the wire bonding pad 2 on the first semiconductor element 1, it is exposed to alpha rays, but even if struck by alpha rays, software errors naturally will not occur if the circuit is not subject to operational error. Moreover, integrated circuit devices in wedge alpha rays are problem are of course limited to the memory parts of MOS dynamic memories, for example, and actual problems do not occur if specified regions are blocked. The second semiconductor element 6, as explained above, of course should have a thickness sufficient to prevent penetration by alpha rays, but if it is less than such a thickness, or if it is exposed to especially intense radiation, for example, a film coating of gold, platinum, tantalum, or tungsten may also be formed. In addition, by forming a plurality of other circuit elements on the surface of the second semiconductor element 6, it is possible not merely to block alpha rays, but also to add more complex circuits to the first semiconductor element 1. In LSI's, in conjunction with the increased scale of integration of the semiconductor element, a reduction in the yield due to so-called defects has occurred, but if this function is the same, by division into multiple parts, the yield can be substantially increased, and from this aspect as well improvement of yield and reduction in cost can be achieved.

As explained in detail above, by means of the simple structure of the semiconductor element according to the present invention, is possible to block alpha rays, and the present invention therefore offers the effect of being able to prevent software errors.

4. Brief Explanation of the Drawings

Figure 1 is a plan view showing a working example of a semiconductor device according to the present invention, and Figure 2 is a cross-sectional view along the line A-A' in Figure 1.

1... first semiconductor element, 2... bonding pad, 3... metallic thin wire, 4... first contact area, 5... semiconductor element mounting stage, 6... second semiconductor element, 7... second contact area, 8... bonding material.

In the figures, the same elements indicate the same or corresponding parts.

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